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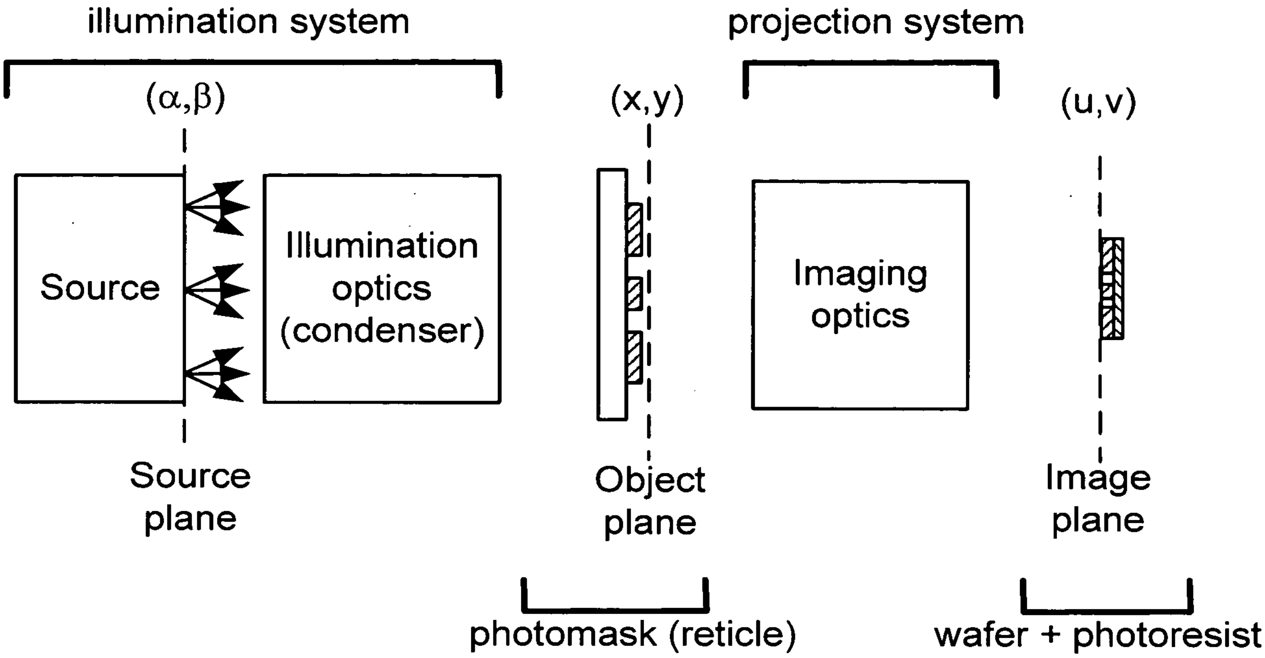


FIG. 1

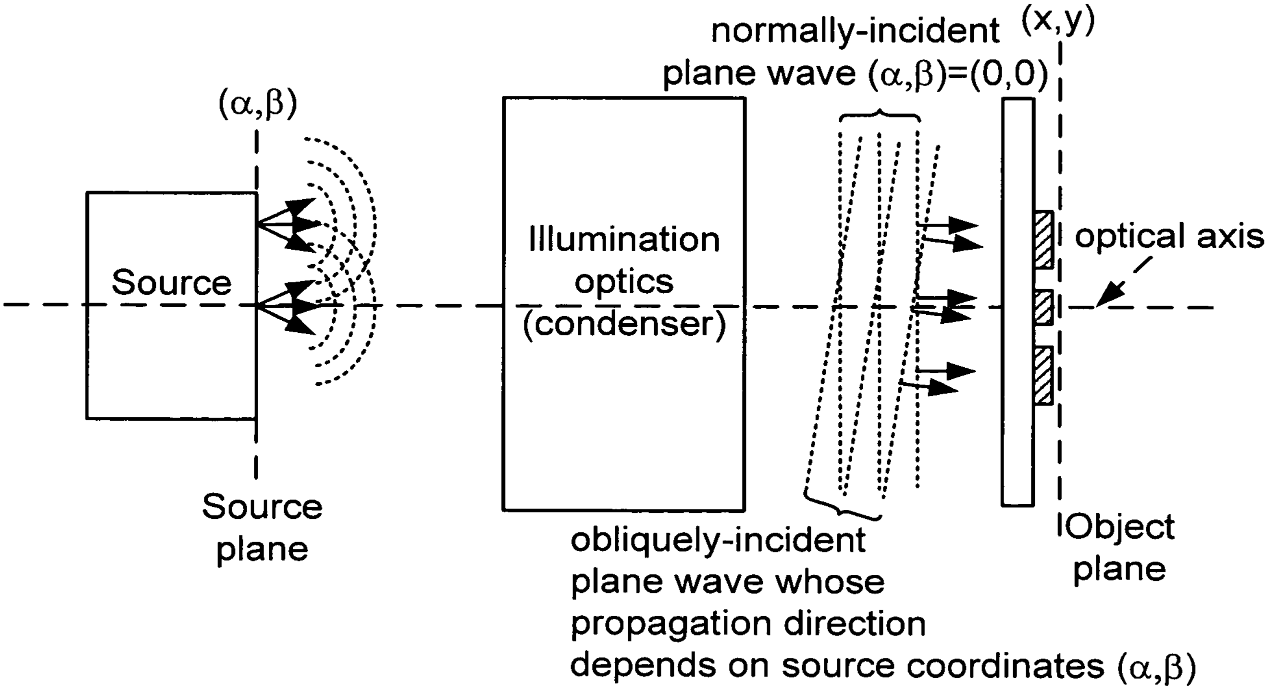

normally-incident plane wave (α,β)=(0,0)
(x,y)
(α,β)
Source
Illumination optics (condenser)
optical axis
Source plane
obliquely-incident plane wave whose propagation direction depends on source coordinates (α,β)
Object plane

FIG. 2A

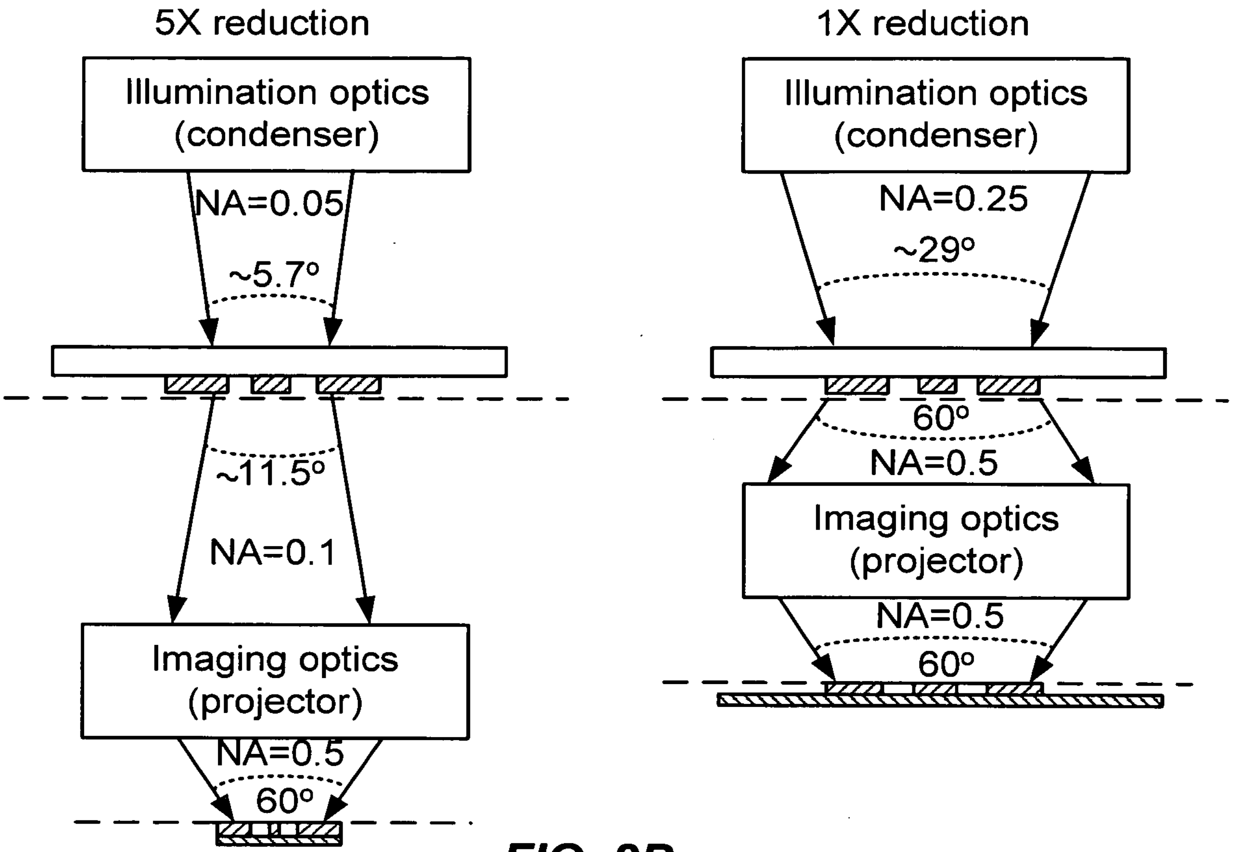

5X reduction
Illumination optics (condenser)
NA=0.05
~5.7°
~11.5°
NA=0.1
Imaging optics (projector)
NA=0.5
60°
1X reduction
Illumination optics (condenser)
NA=0.25
~29°
60°
NA=0.5
Imaging optics (projector)
NA=0.5
60°

FIG. 2B

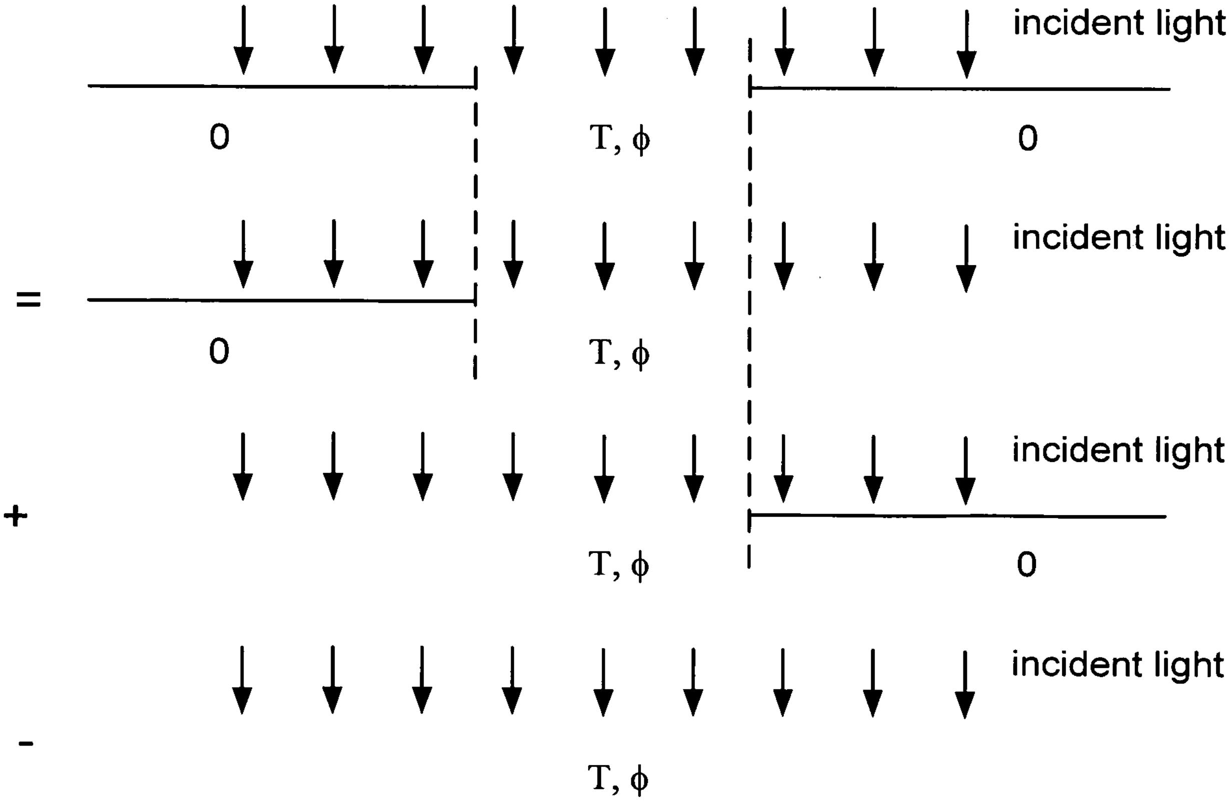

incident light
0
T, ϕ
0
=
incident light
0
T, ϕ
+
incident light
T, ϕ
0
-
incident light
T, ϕ

FIG. 4

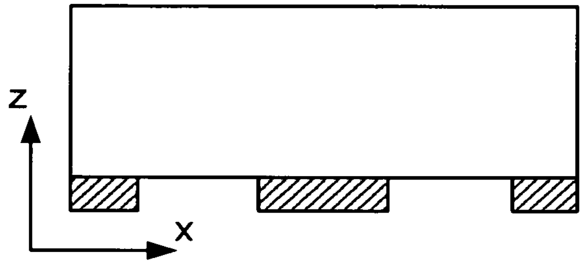


FIG. 3A

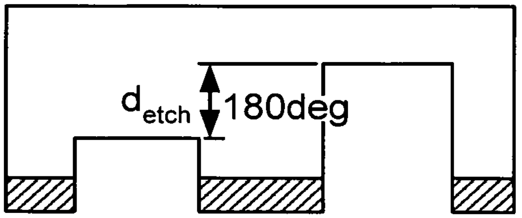


FIG. 3B

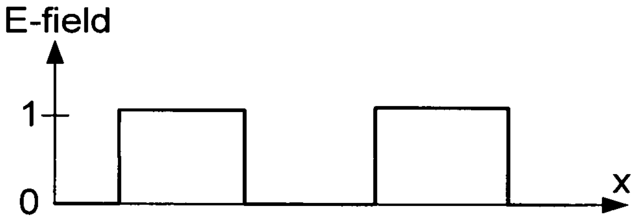


FIG. 3C

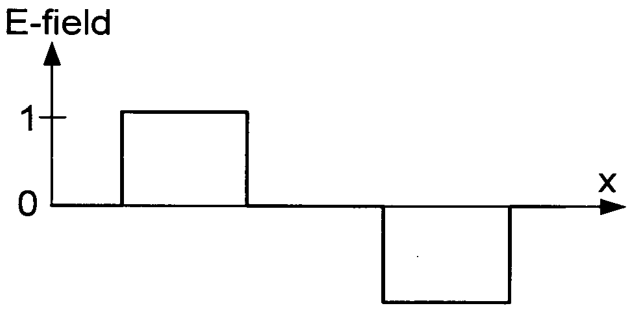


FIG. 3D

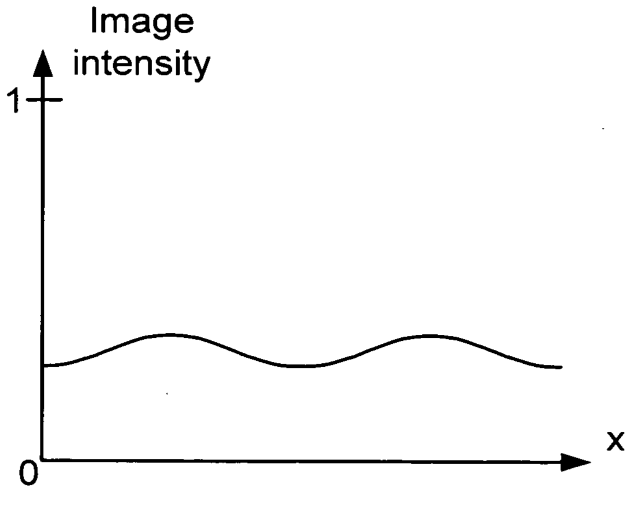


FIG. 3E

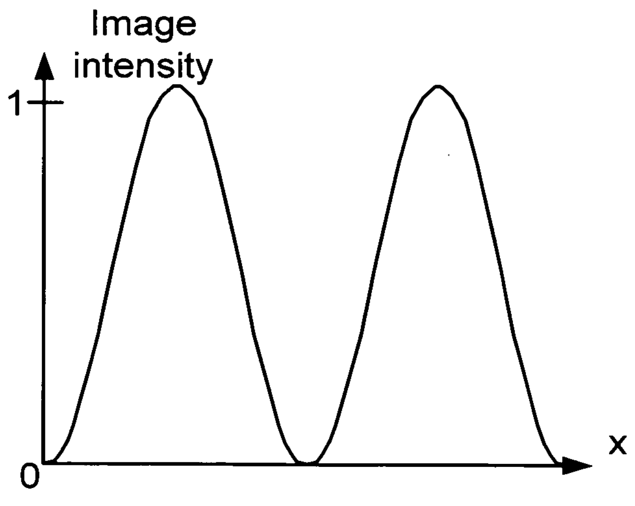


FIG. 3F

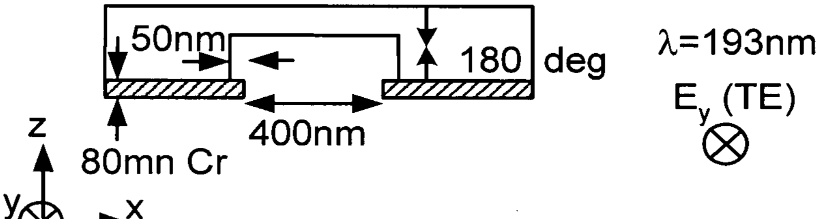


FIG. 5A

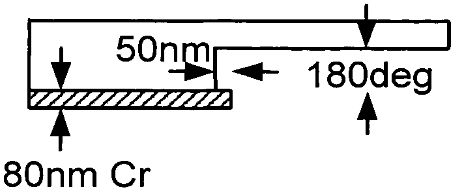


FIG. 5B

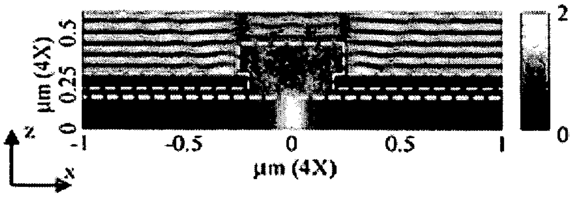


FIG. 5C

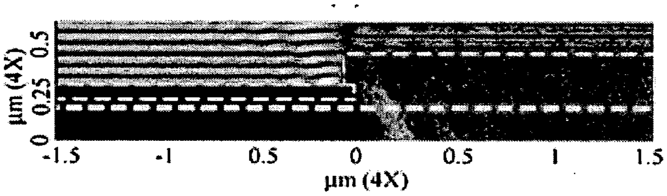


FIG. 5D

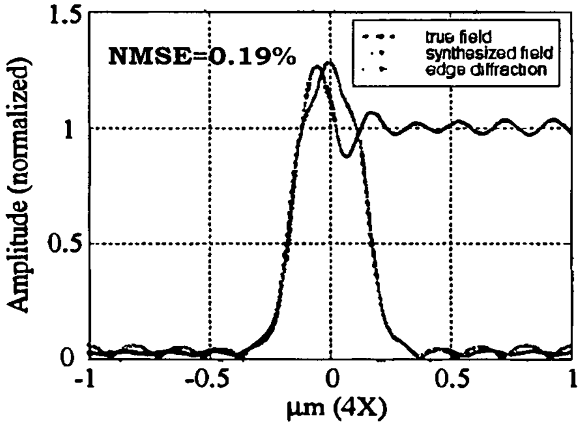


FIG. 5E

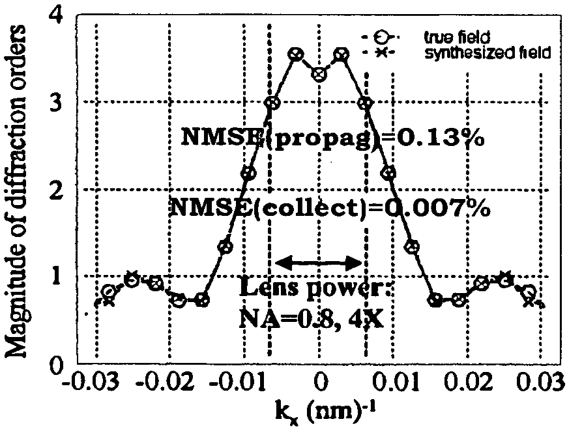


FIG. 5F

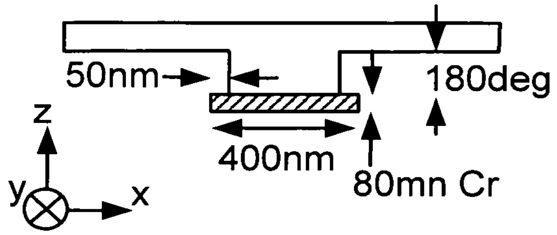


FIG. 6A

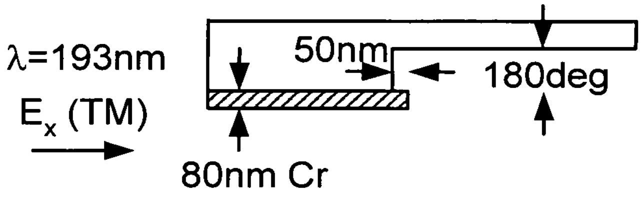


FIG. 6B

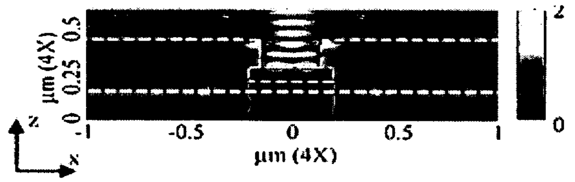


FIG. 6C

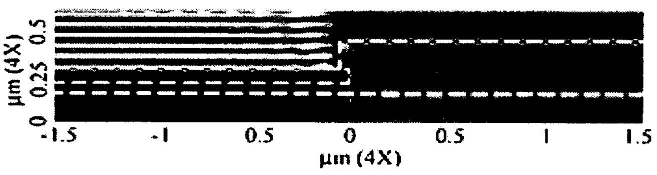


FIG. 6D

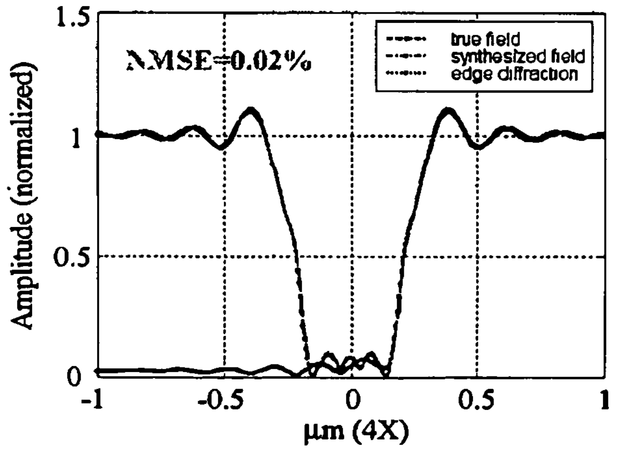


FIG. 6E

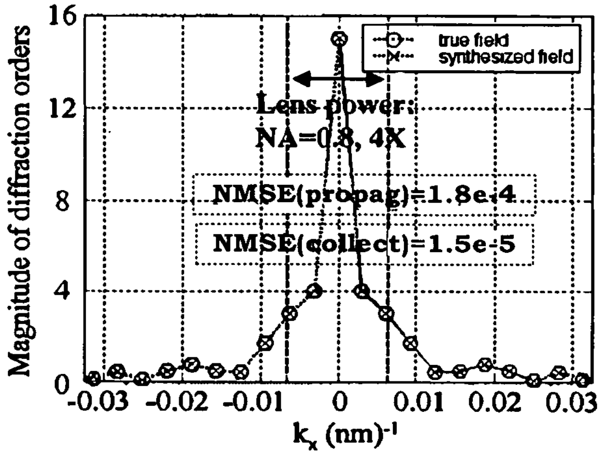


FIG. 6F

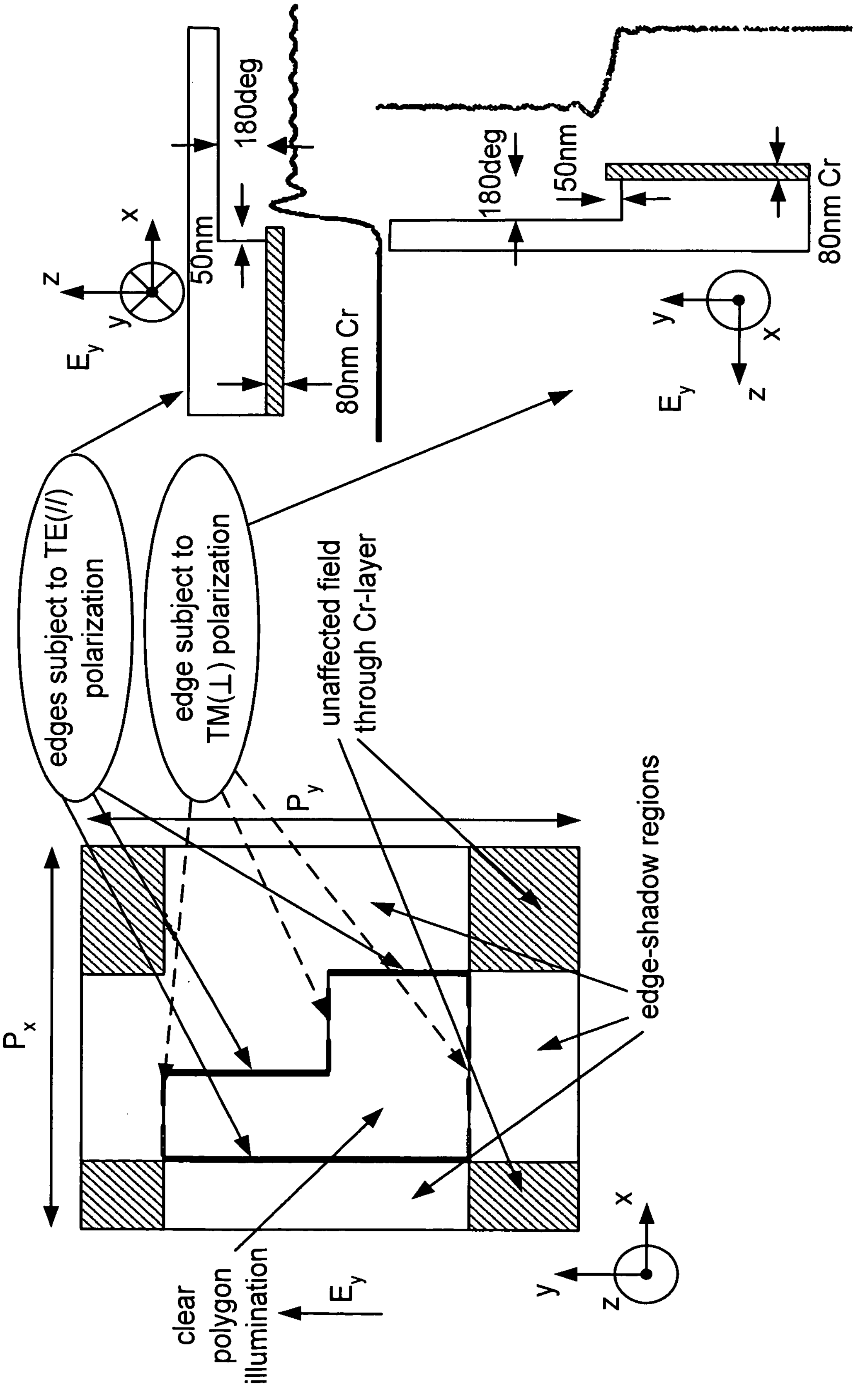
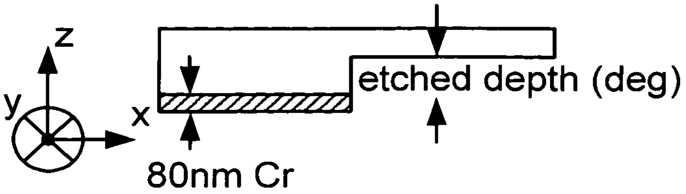

edges subject to TE(//) polarization
edge subject to TM(⊥) polarization
unaffected field through Cr-layer
edge-shadow regions
clear polygon illumination
E_y
P_x
P_y
x
y
z
50nm
180deg
80nm Cr
E_y
x
y
z
180deg
50nm
80nm Cr
E_y
x
y
z

FIG. 7



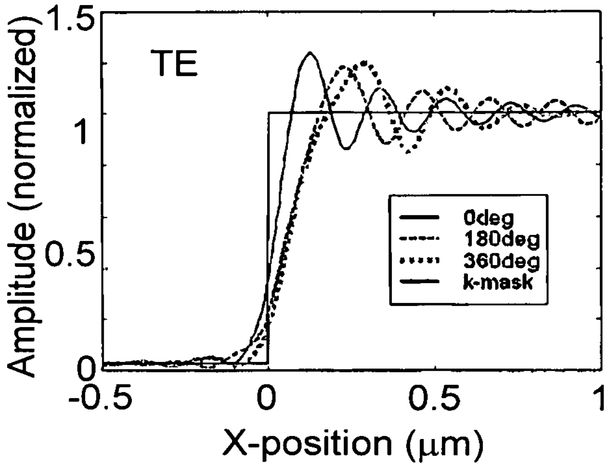


FIG. 8A

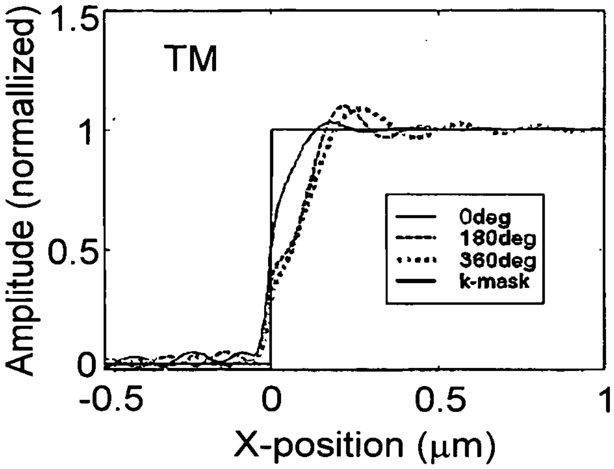
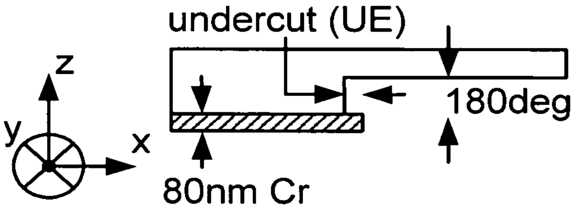


FIG. 8B



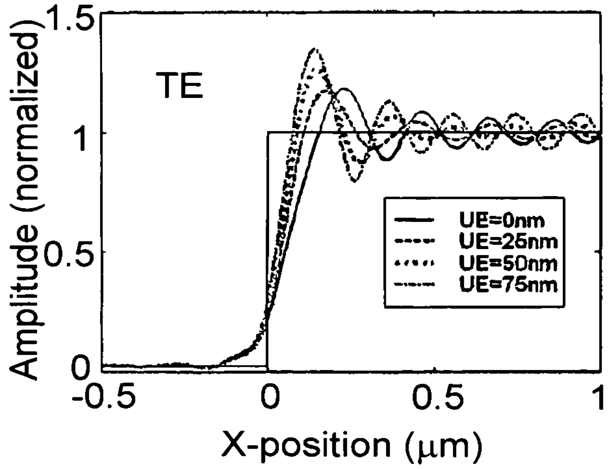


FIG. 8C

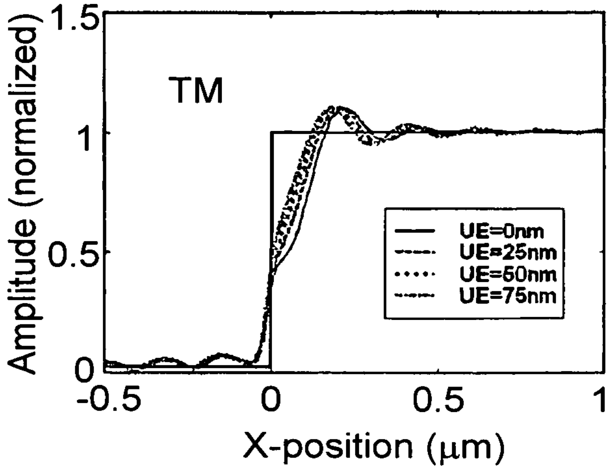


FIG. 8D

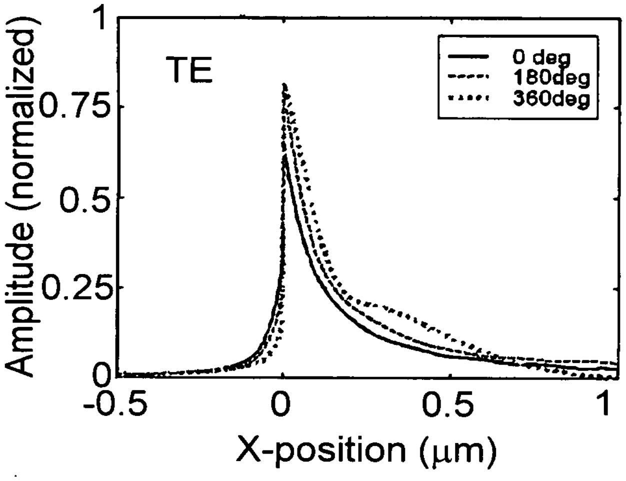


FIG. 9A

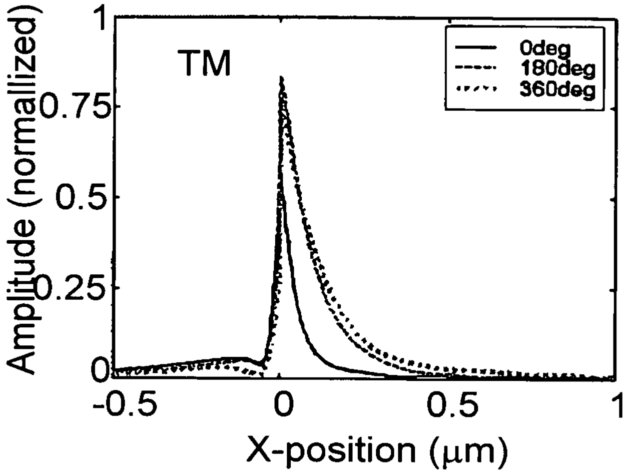


FIG. 9B

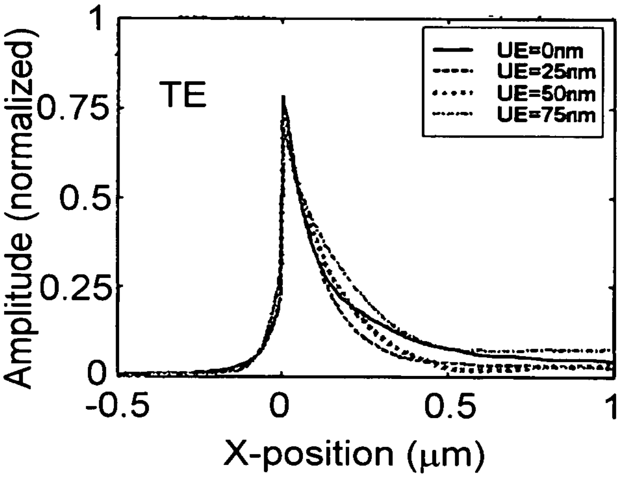


FIG. 9C

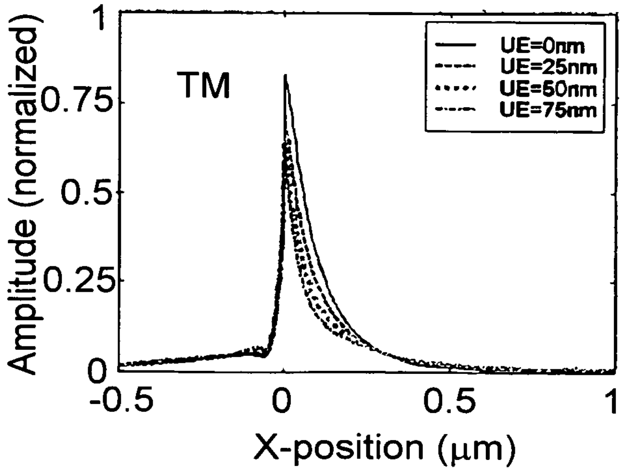


FIG. 9D

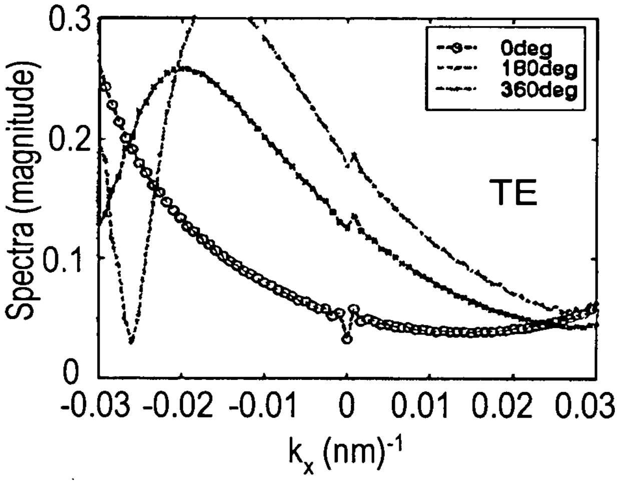


FIG. 10A

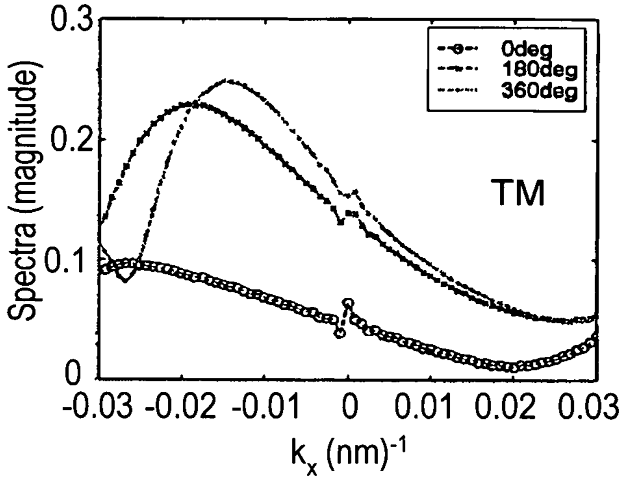


FIG. 10B

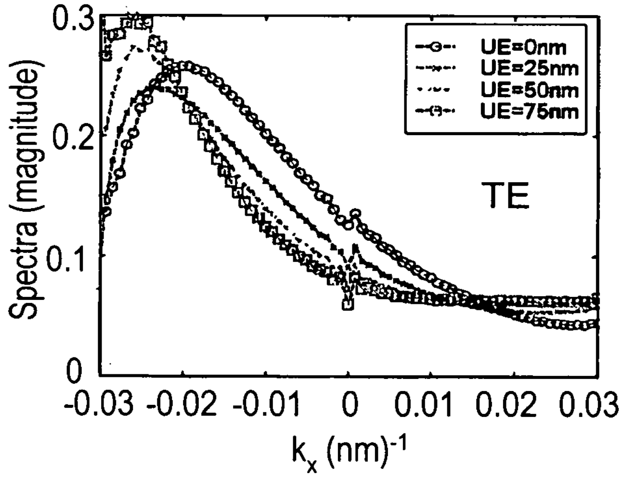


FIG. 10C

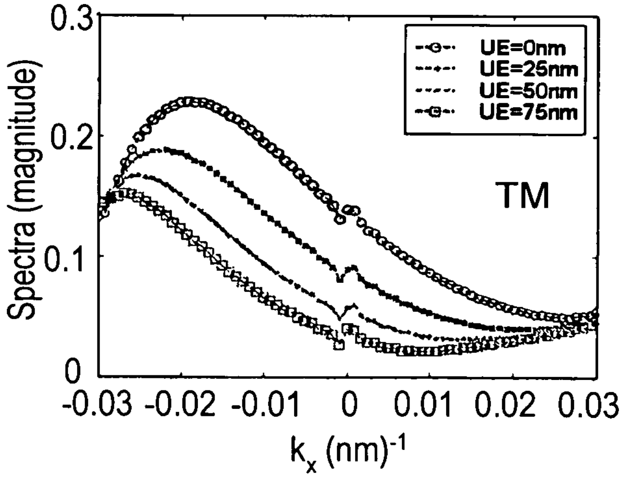


FIG. 10D

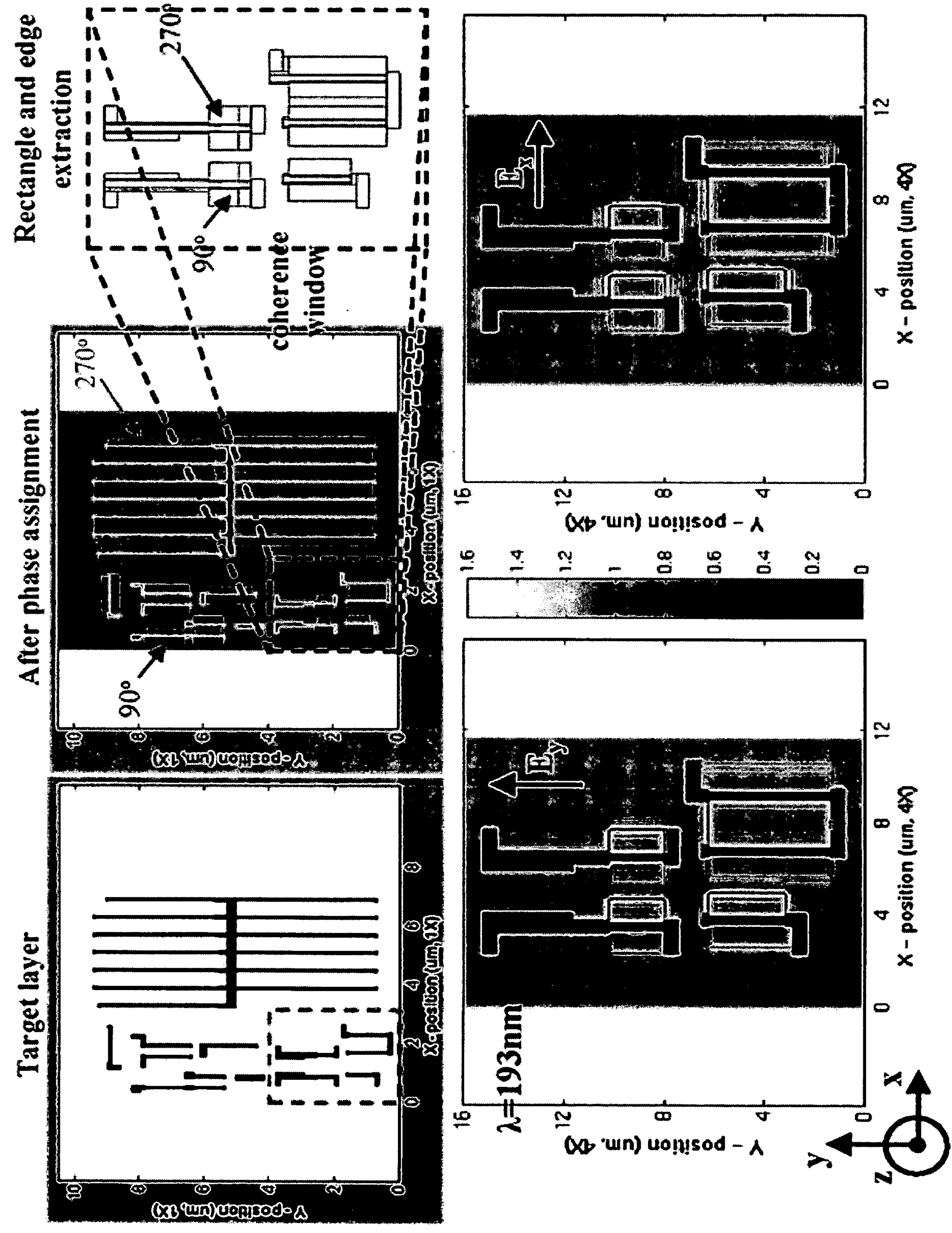

Target layer
After phase assignment
Rectangle and edge extraction
90°
270°
coherence window
Y - position (um, 1X)
X - position (um, 1X)
0
2
4
6
8
10
λ=193nm
E_y
E_x
Y - position (um, 4X)
X - position (um, 4X)
0
4
8
12
16
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
x
y
z

FIG. 11

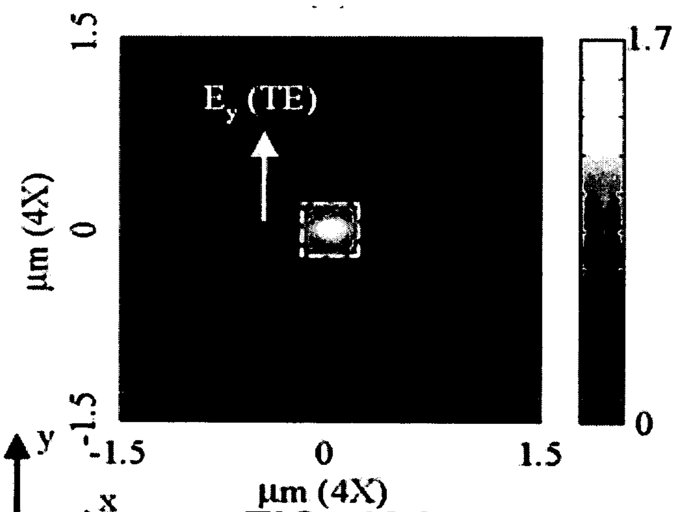


FIG. 12A

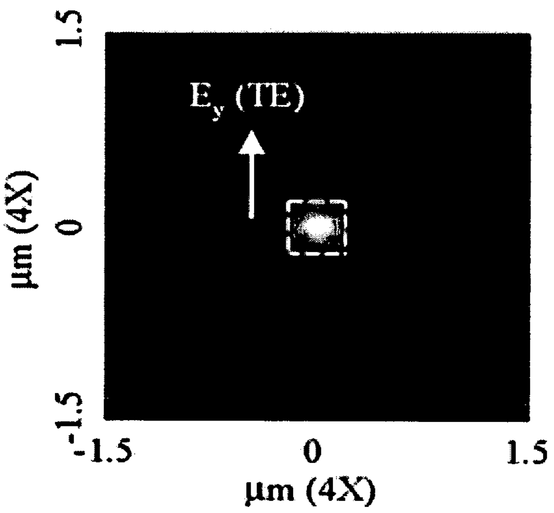


FIG. 12B

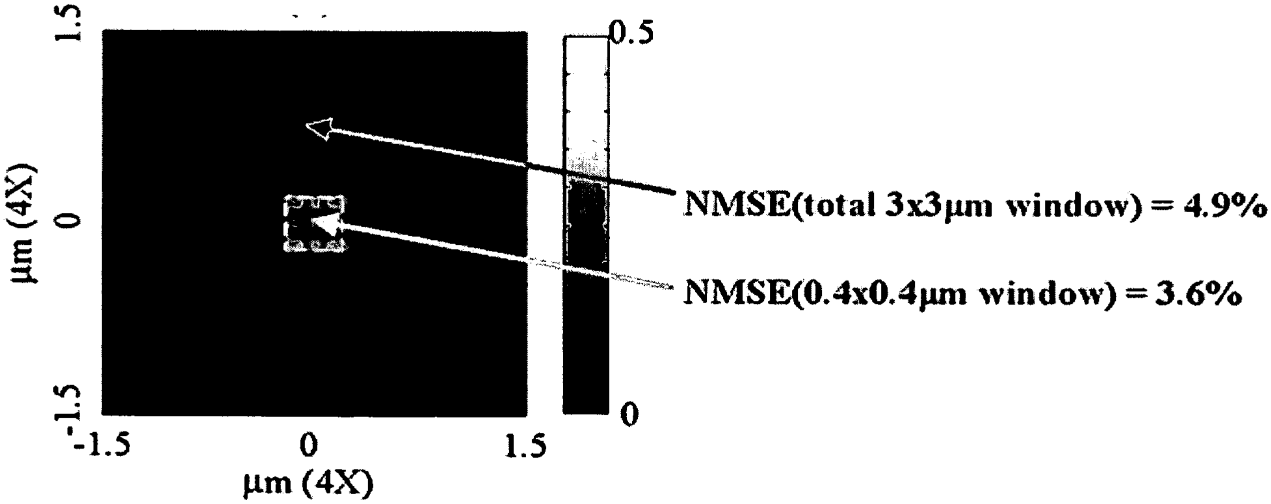


FIG. 12C

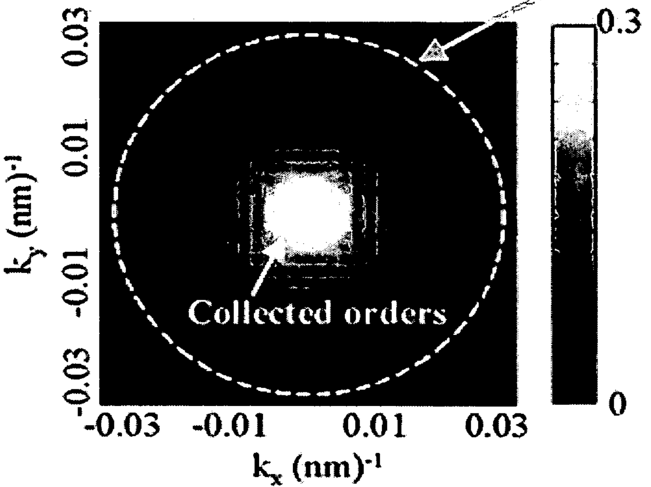


FIG. 13A

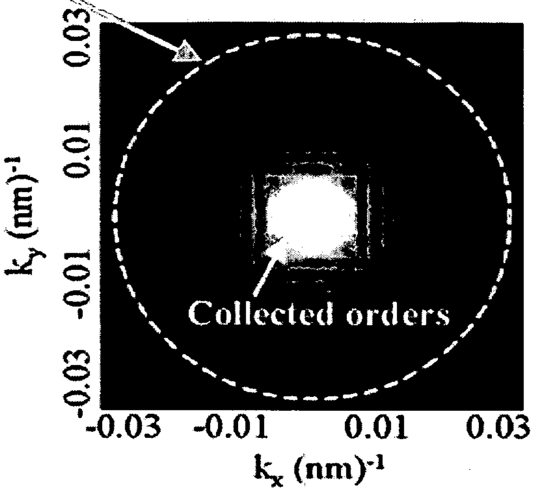


FIG. 13B

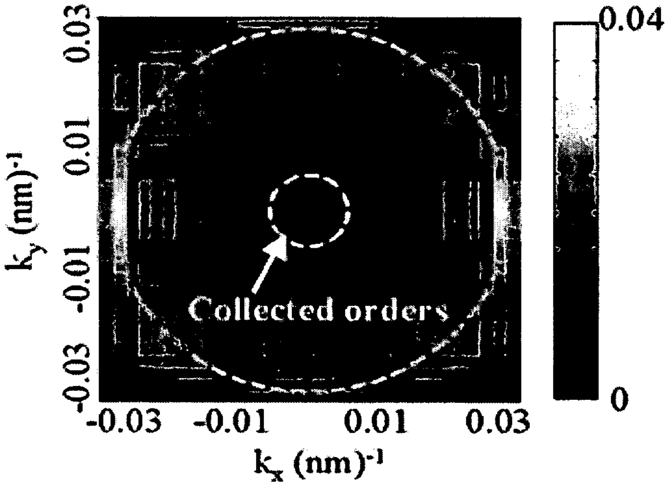


FIG. 13C

NMSE(propagated orders) = 2.2%

NMSE(collected orders) = 2e-4

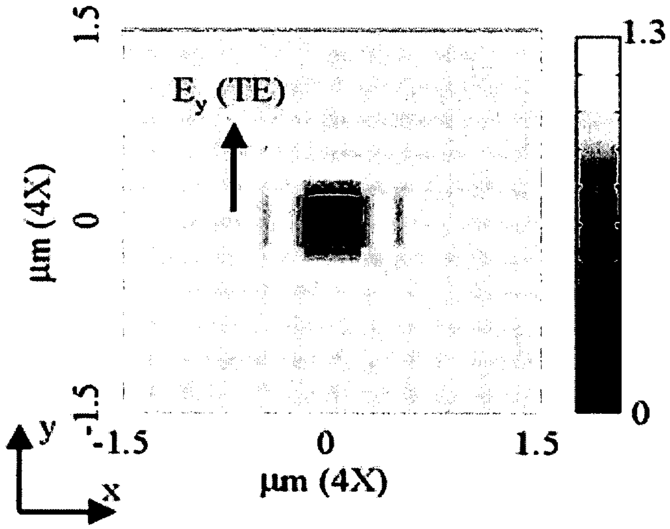


FIG. 14A

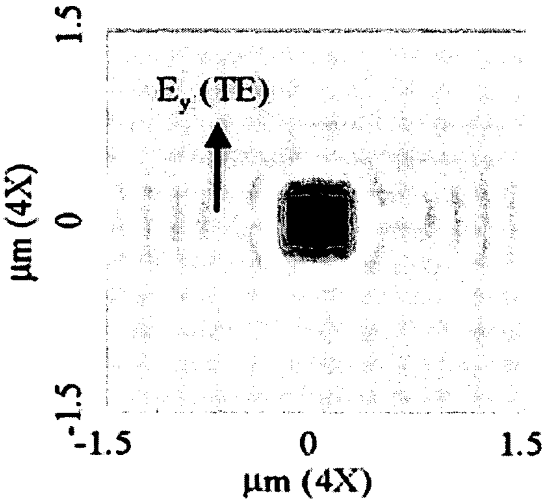
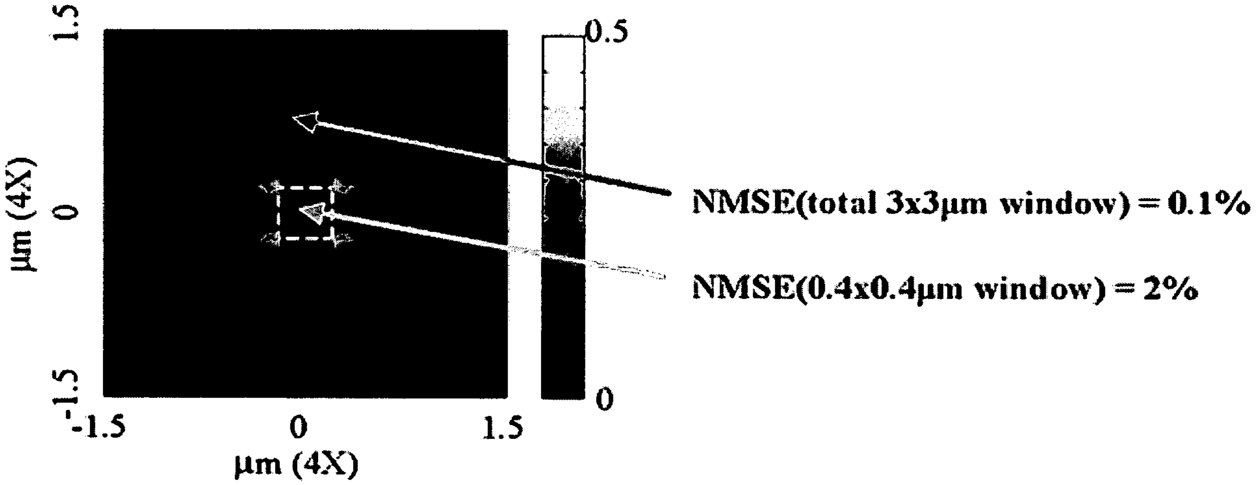


FIG. 14B



NMSE(total 3x3µm window) = 0.1%

NMSE(0.4x0.4µm window) = 2%

FIG. 14C

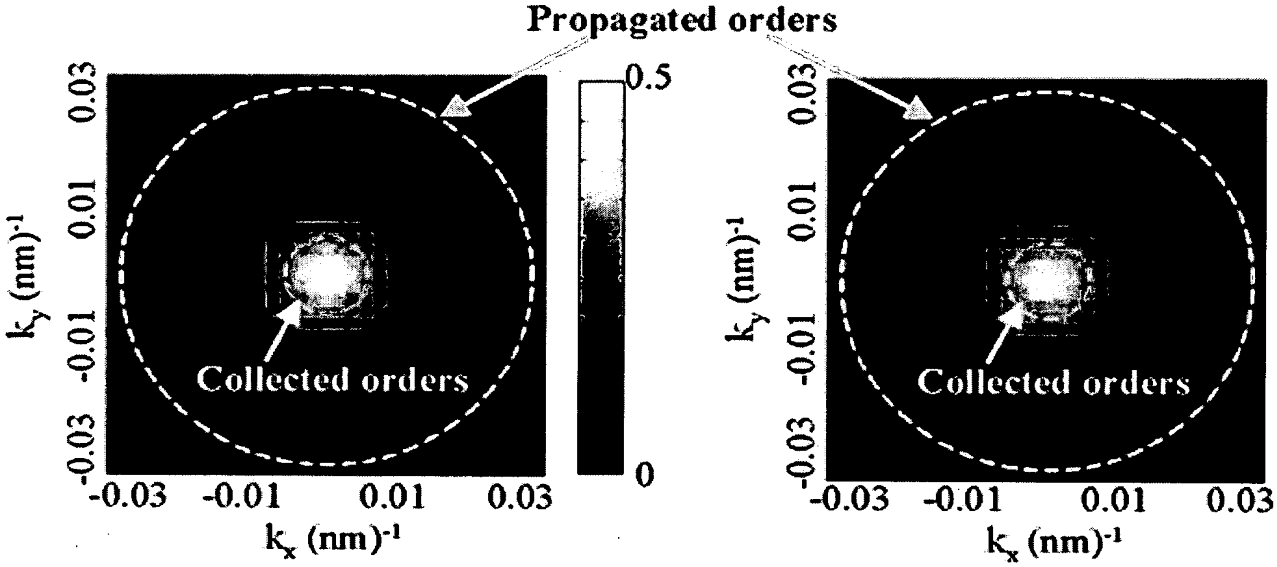
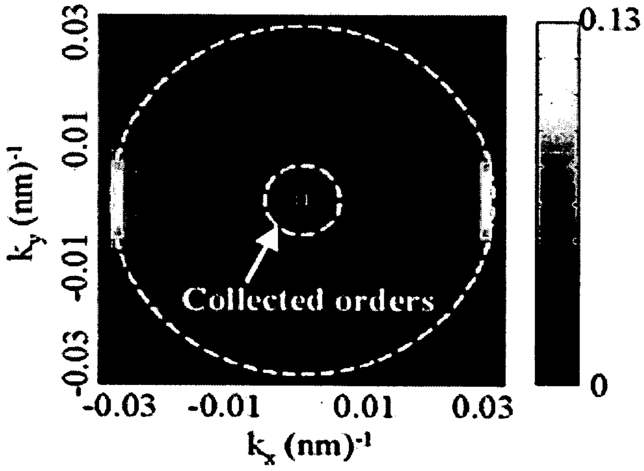


FIG. 15A

FIG. 15B



NMSE(propagated orders) = 4%

NMSE(collected orders) = 0.16%

FIG. 15C

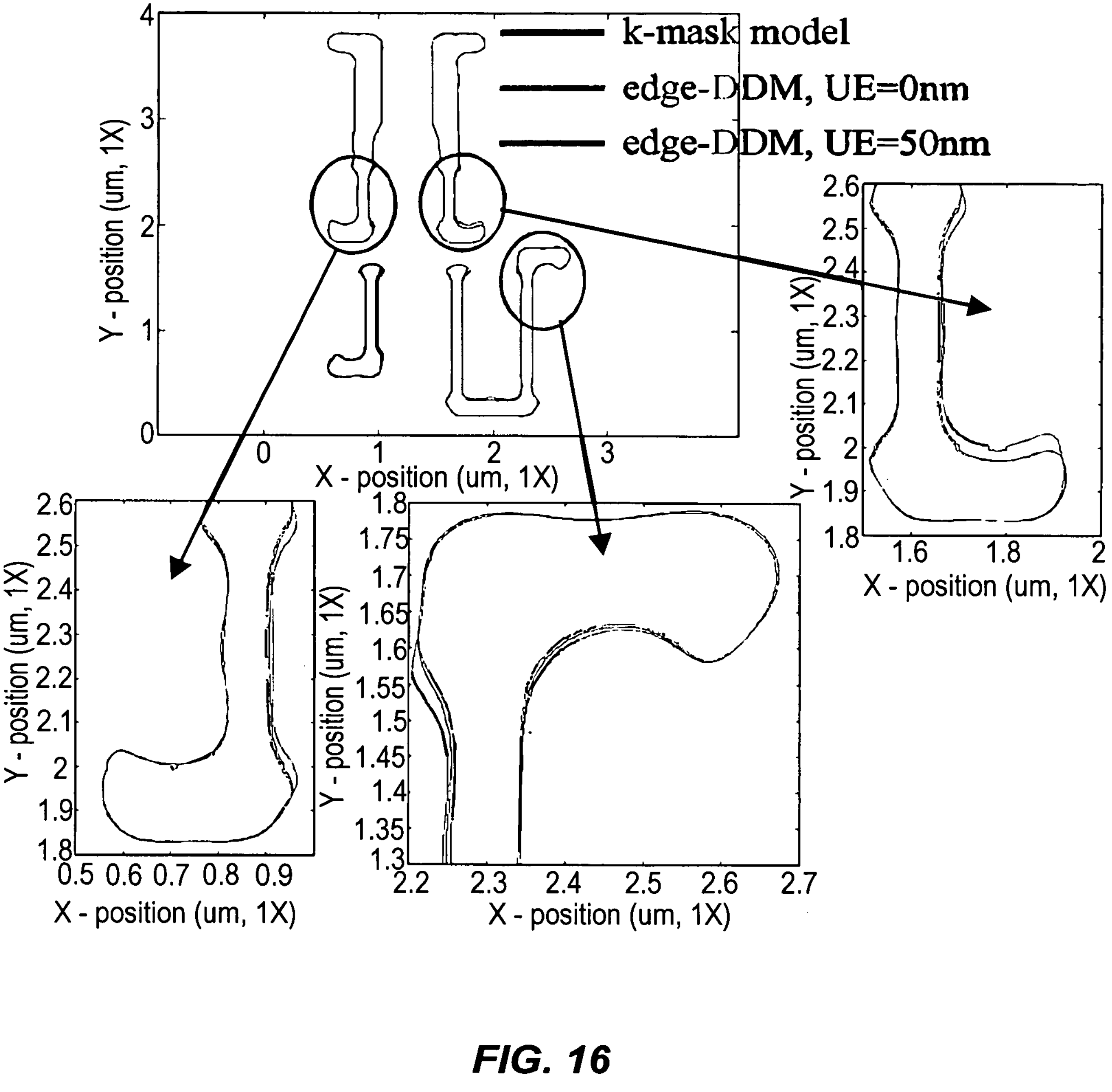
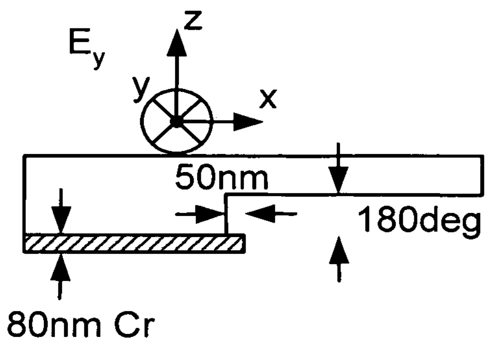

k-mask model
edge-DDM, UE=0nm
edge-DDM, UE=50nm
Y - position (um, 1X)
X - position (um, 1X)
0
1
2
3
4
2.6
2.5
2.4
2.3
2.2
2.1
2
1.9
1.8
1.6
1.8
0.5 0.6 0.7 0.8 0.9
1.75
1.7
1.65
1.6
1.55
1.5
1.45
1.4
1.35
1.3
2.2
2.3
2.4
2.5
2.6
2.7

FIG. 16



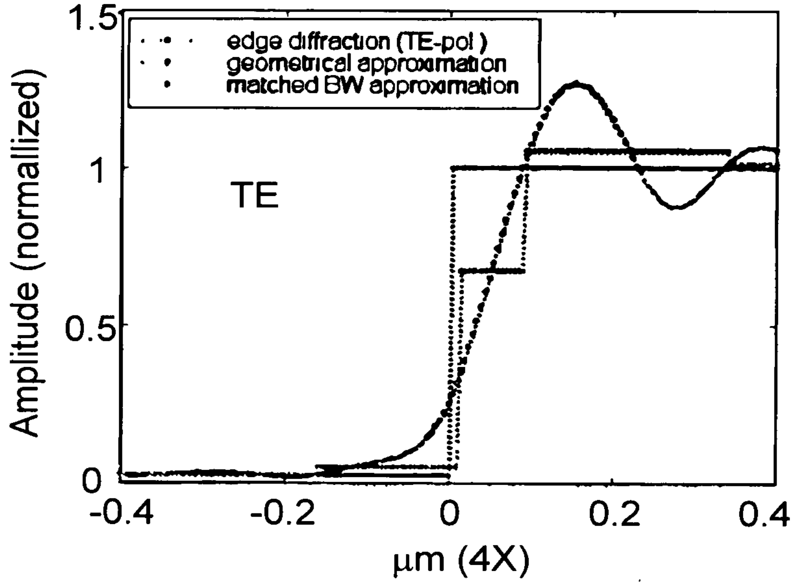


FIG. 17A

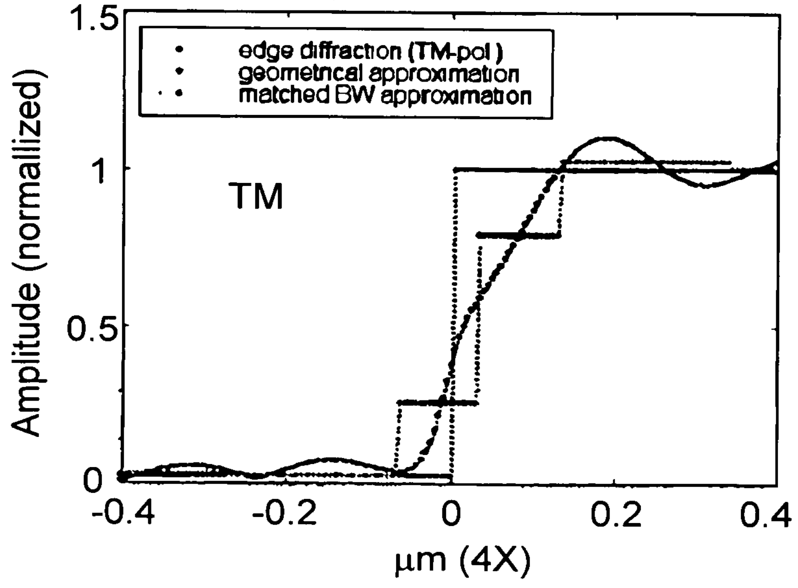


FIG. 17B

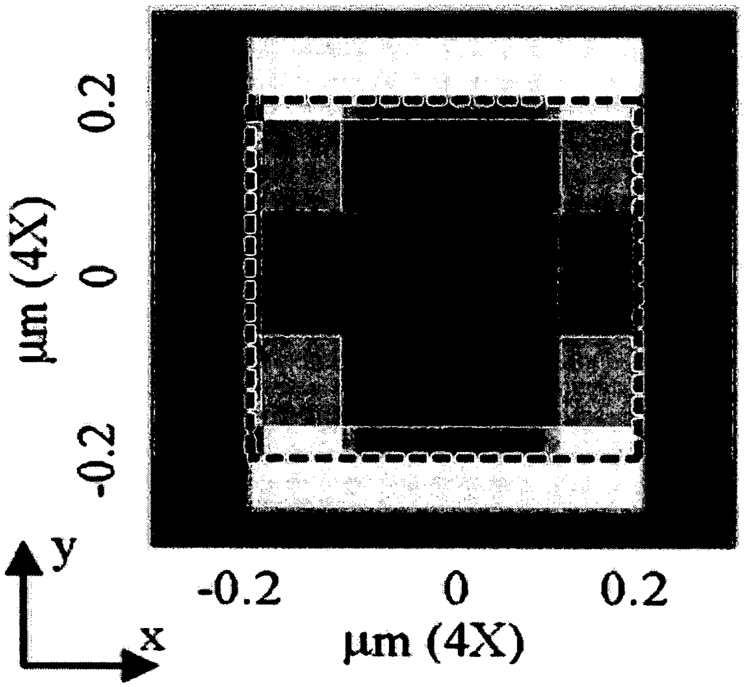


FIG. 18A

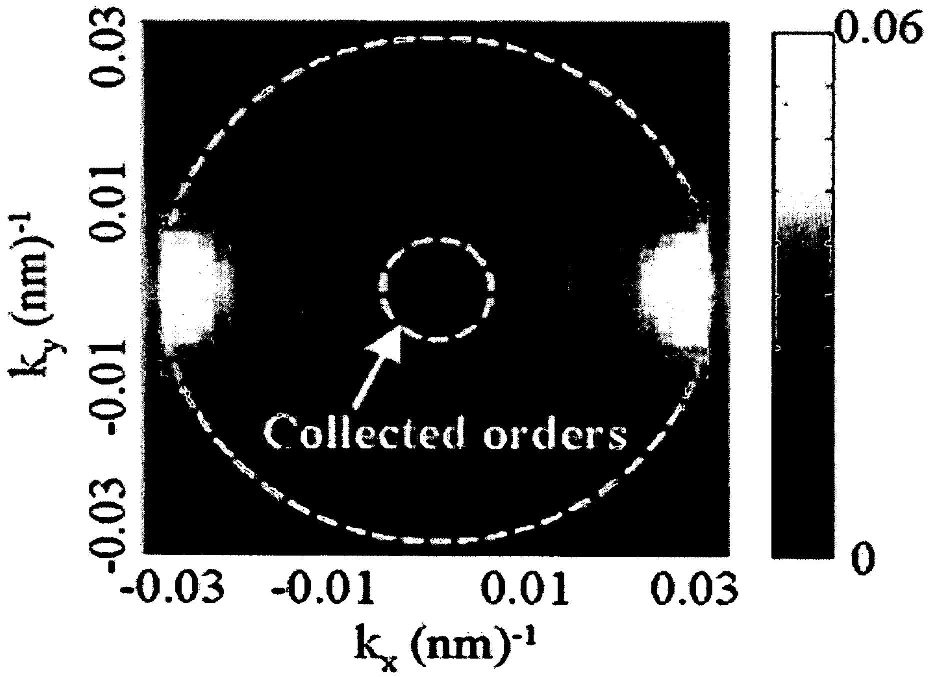


FIG. 18B

NMSE(propagated orders) = 5.7% (was 2.2%)

NMSE(collected orders) = 8.6e-4 (was 2e-4)

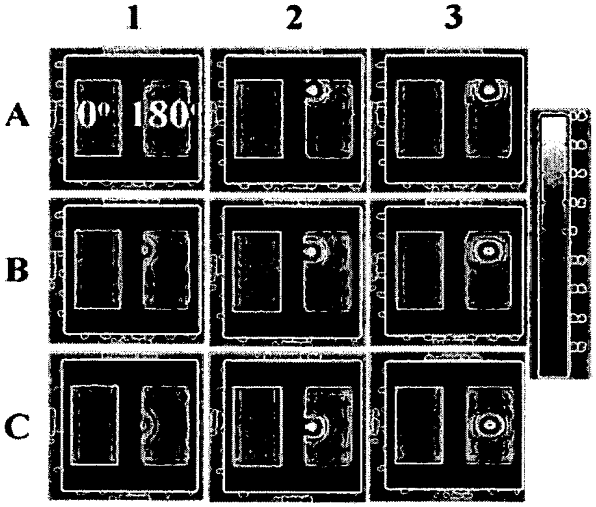


FIG. 19A

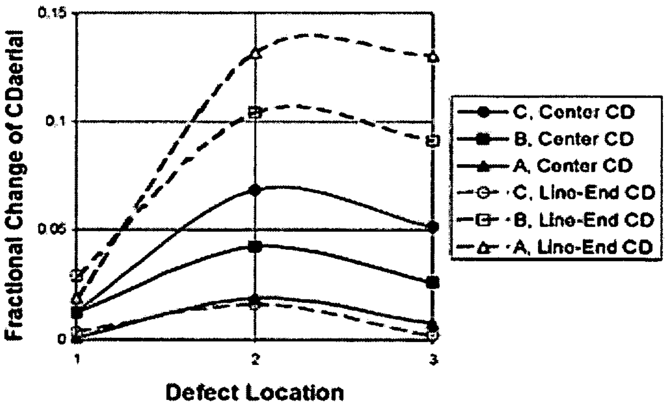


FIG. 19B

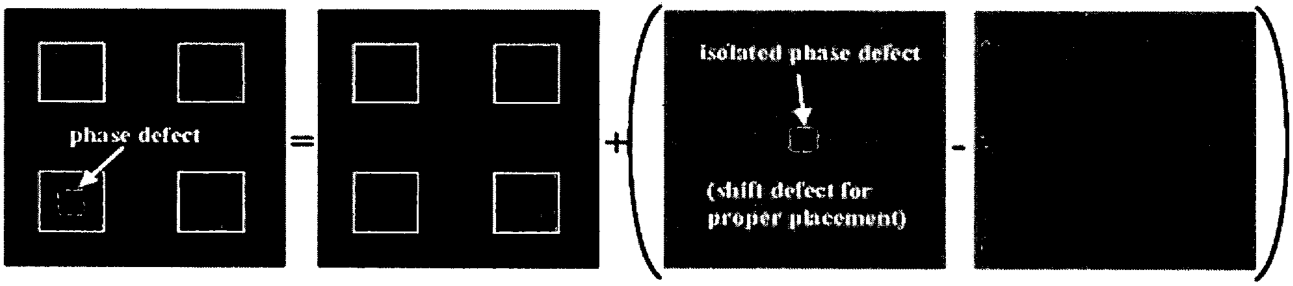


FIG. 20

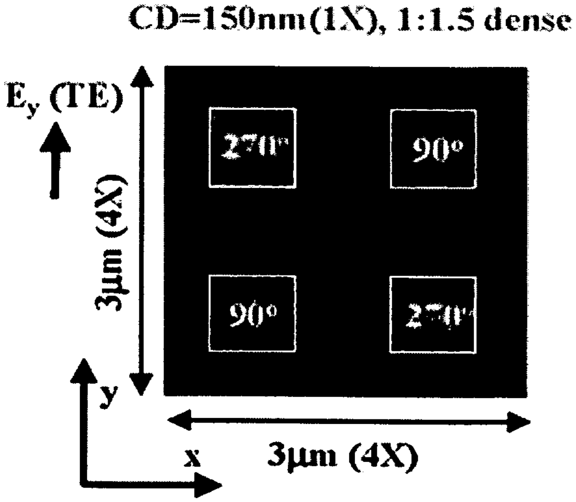


FIG. 21A

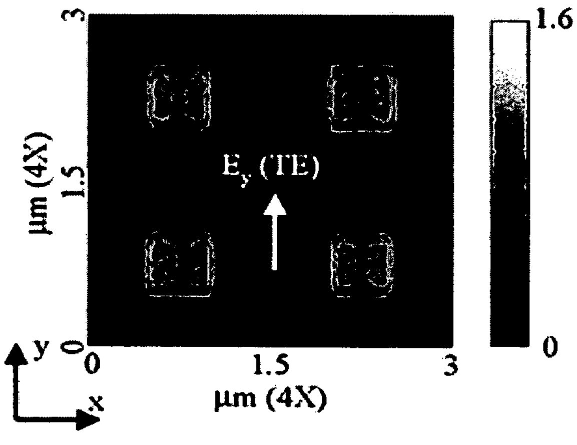


FIG. 21B

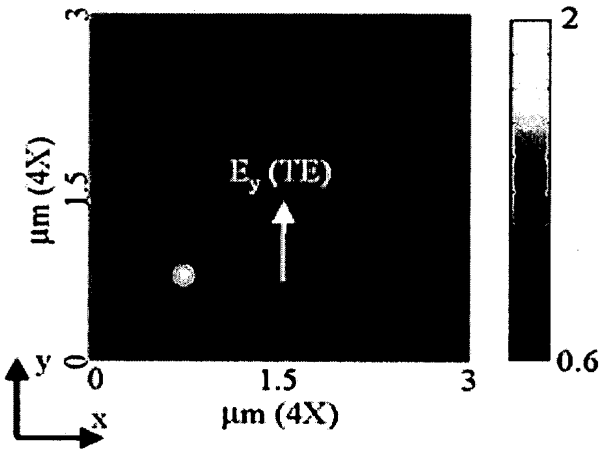


FIG. 22A

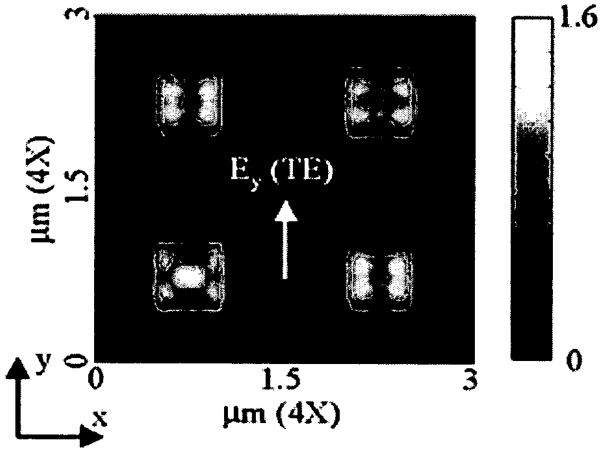


FIG. 22B

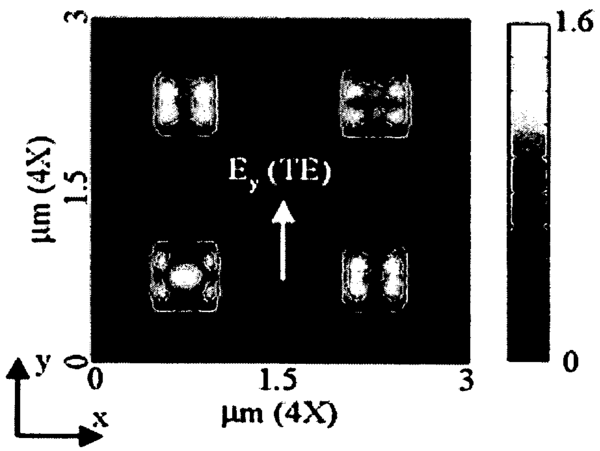


FIG. 22C

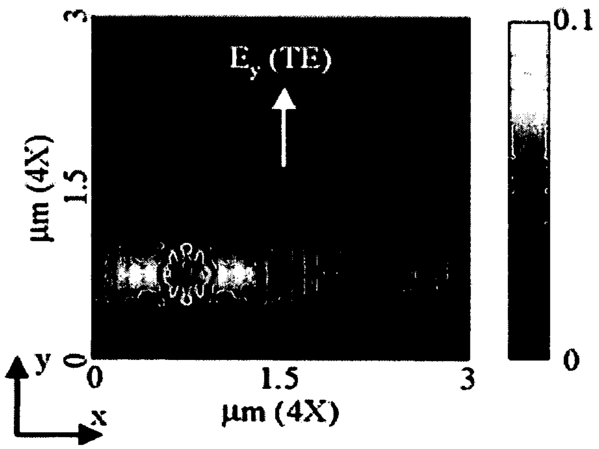


FIG. 22D

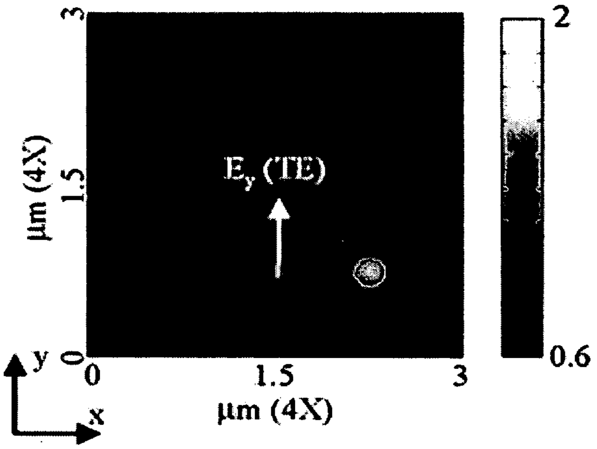


FIG. 23A

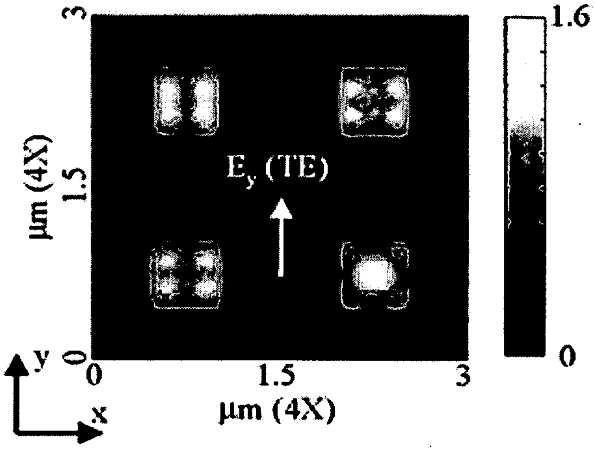


FIG. 23B

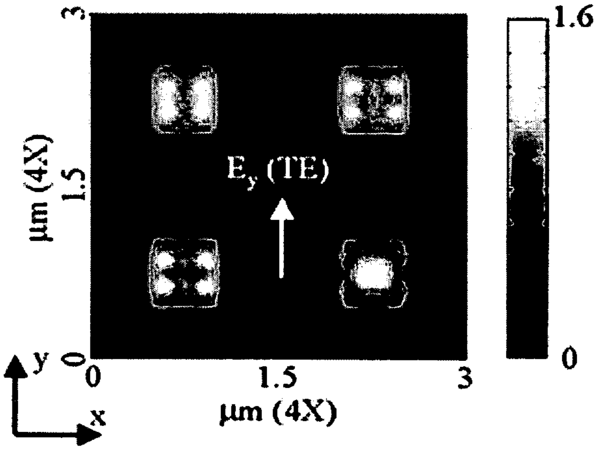


FIG. 23C

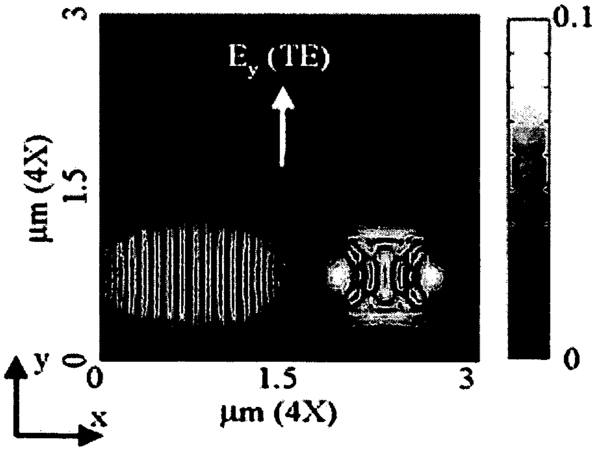


FIG. 23D

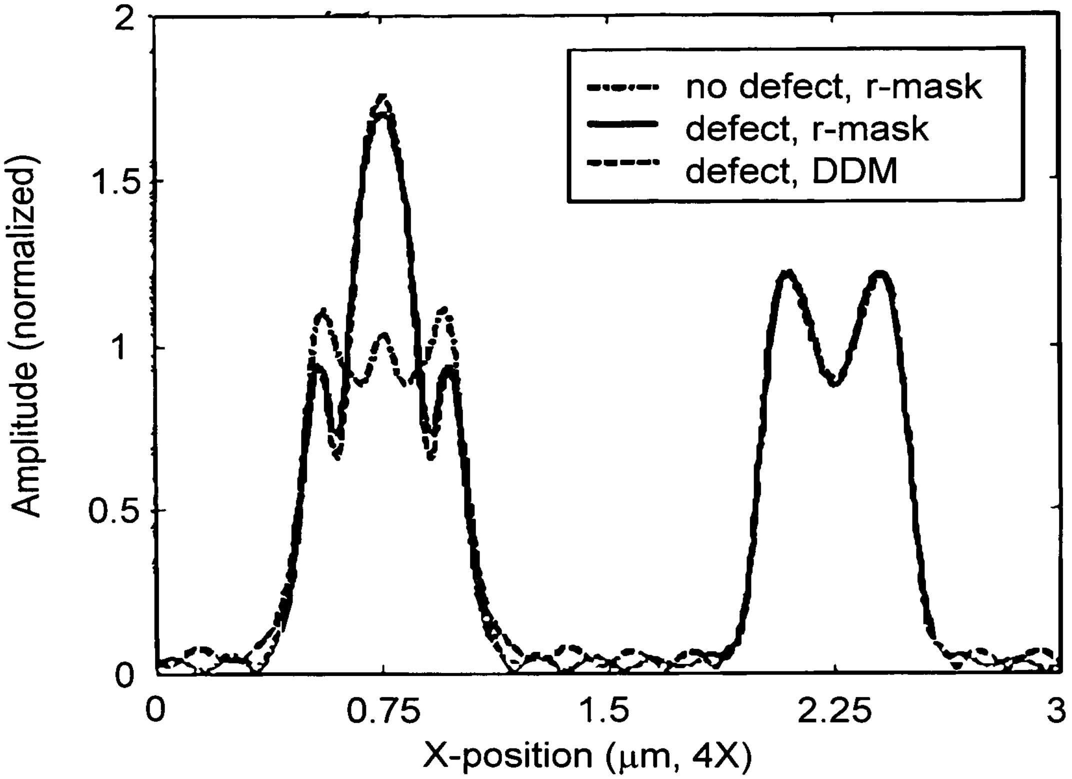


FIG. 24A

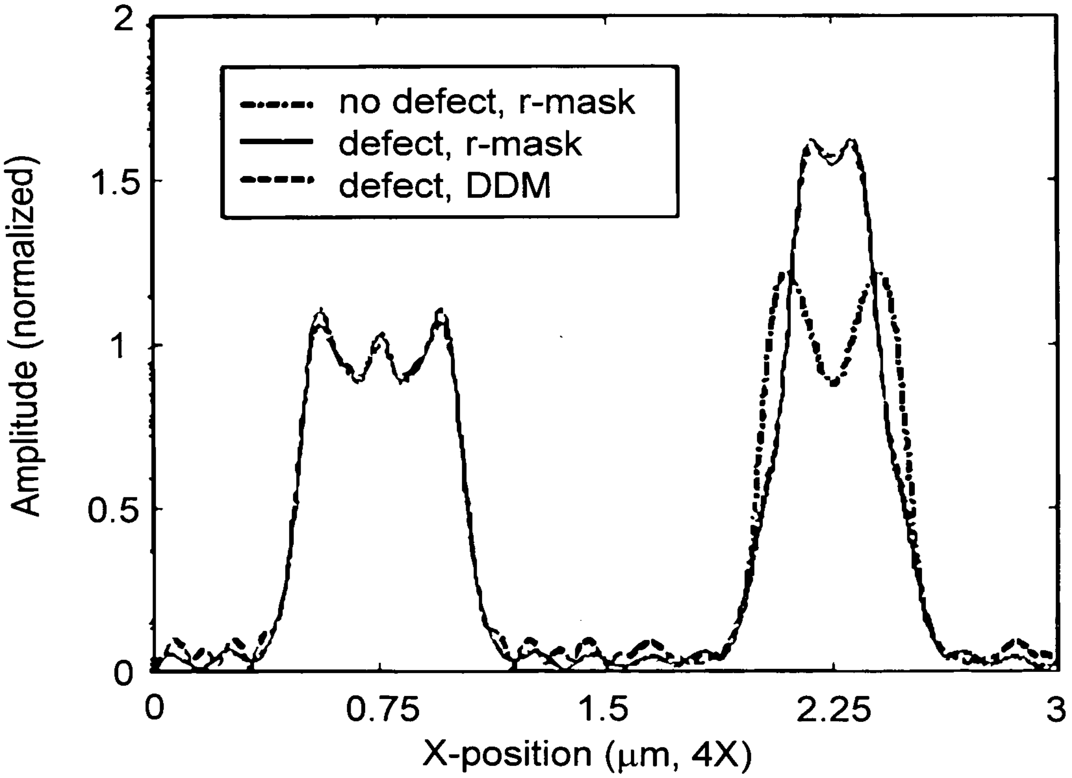


FIG. 24B

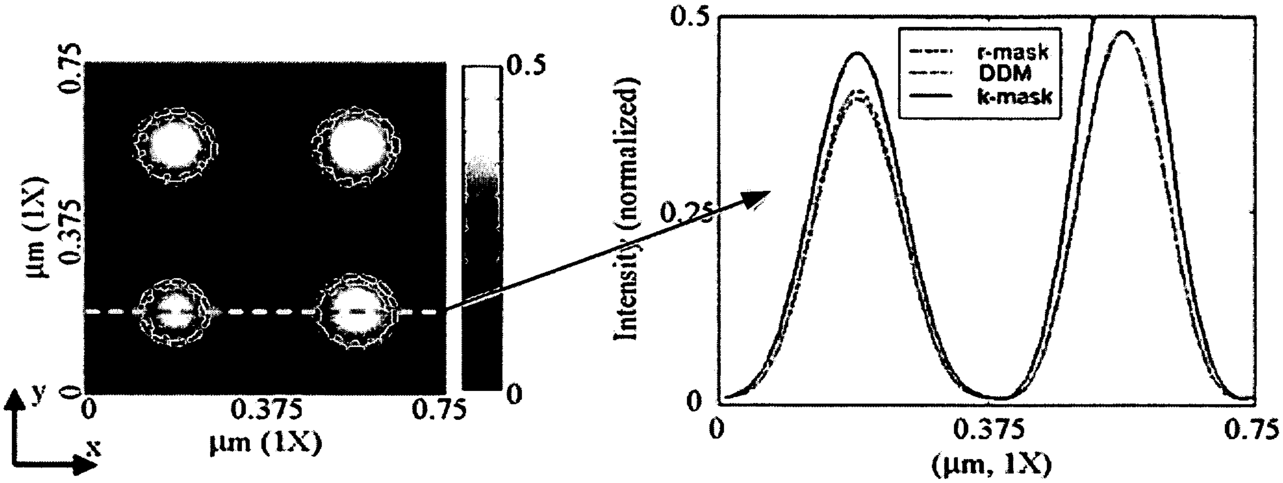


FIG. 25A

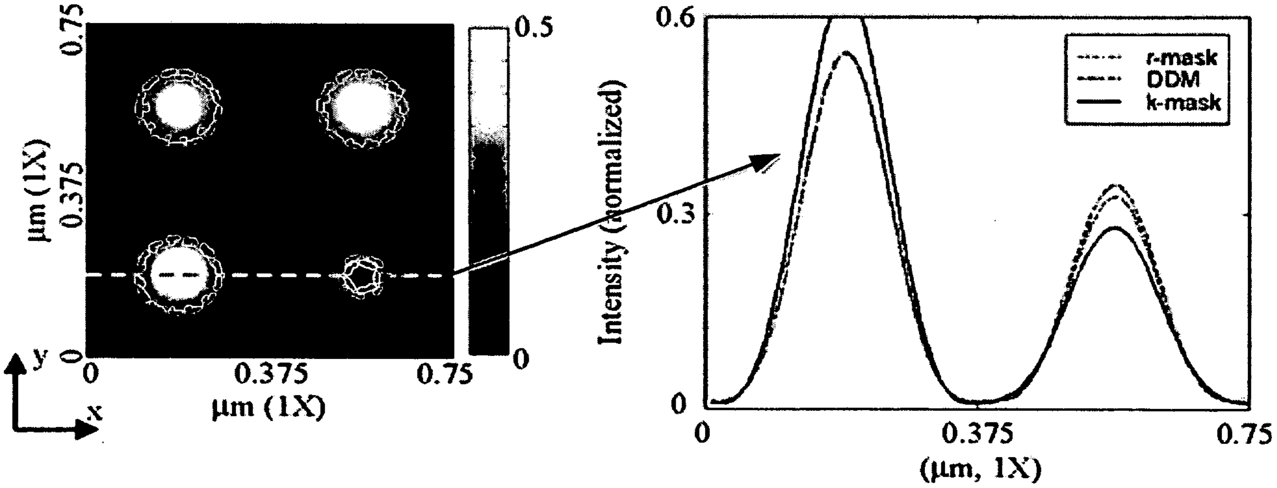


FIG. 25B

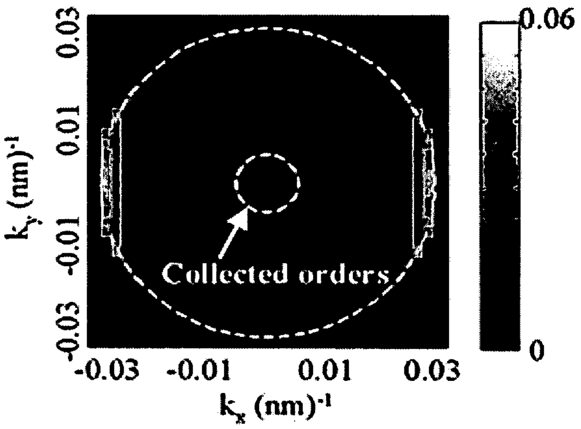


FIG. 26A

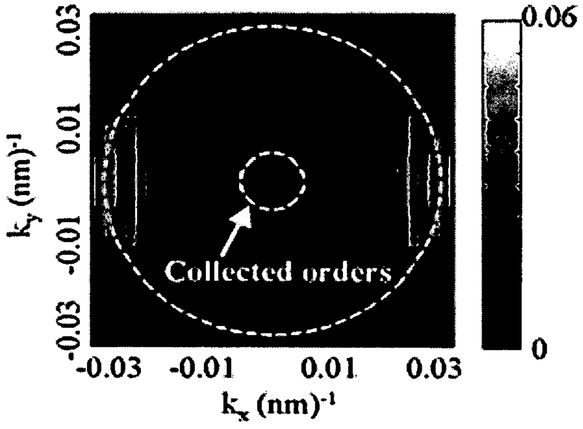


FIG. 26B